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T. carolina Linne.

Bronxville, N. Y., V (Woodruff); Yaphank, N. Y., VII; Wading River, N. Y., VIII; Staten Island, IV, V, VI, VII, IX, X; Newfoundland, N. J., IX; Great Notch, N. J., V; Jamesburg, N. J., IX; Lakehurst, N. J., IV, 25, 1908, many individuals and a pair in copulation; VI, VIII. Only two or three of our dragonflies have as long a season as this, namely from April to October. We quote the following from the "Preliminary List of the Dragonflies of Staten Island with notes and Dates of Capture" (this JOURNAL, Sept., 1898): "On July 15, 1894, a male *Tramea carolina* was flying over one of the Four Corners iron mine ponds. Soon a female came and commenced dipping her abdomen into the water. In a moment she was seized by the male and they flew away. In a half hour they were back and went flying about together, the male now and then suddenly letting go his hold and with equal rapidity catching the female again by the neck. Other male dragonflies flew after them and when the female stopped to lay eggs, they annoyed her considerably. The chief among the disturbers was a *Libellula basalis*. After a time the male *Tramea* left his mate and she was quickly seized by the aforesaid *Libellula basalis*, after which they flew about together for a considerable time. After letting go his hold once and flying down the pond, the *L. basalis* returned and seized the *Tramea* a second time."

AQUATIC HEMIPTERA.

BY H. G. BARBER,

ROSELLE PARK, N. J.

The aquatic Hemiptera have excellent and frequently wonderful adaptations to their environment, exhibiting among them most marvelous variability of construction for their life in or on the water. The local, strictly aquatic species, belong to ten families of the heteropterous Hemiptera. These for convenience of treatment of relation of adaptations to habit may be grouped into (1) those which spend their active existence on the surface of the water, (2) those which habitually walk about upon some substratum beneath the water and (3) those which are, for the most part, free swimmers.

In all of these the most striking adaptations of structure are connected with habits of locomotion, breathing and feeding, which are variously modified to suit the particular environment referred to above. With few exceptions these are all carnivorous and are equipped with the short stout beaks necessary for piercing the tissues and sucking the juices of animals. Correlated with this, the great majority have the fore legs modified for seizing and holding the prey.

Although a few forms in the west have been recorded as occurring in water strongly impregnated with various mineral salts, and a few of our local forms in brackish water, they are for the most part strictly fresh water forms. The species likely to occur in any body of water is determined somewhat by the character of the water, the nature of the current and the presence or absence of accumulated plant life. Some species preferring the swift moving stream in which they seem to love to sport against the force of the current; others, and perhaps the greatest number, are found only in still waters of ponds or the quiet waters of bayed out parts of streams where they sometimes congregate in immense numbers.

Quite a number of these aquatic hemiptera, notably members of the families Belostomatidæ, Corixidæ and Notonectidæ, have well-developed wings and readily migrate from one body of water to another and at such times, as has been frequently observed, are attracted to bright lights. The great majority of species, however, are fixed in their environment and though provided with wings are frequently incapable of flight. Others are dimorphic as to wings. In the Gerridæ and allied families there occur a number of species in both the winged and unwinged state.

The species which live actively upon the surface of the water belong to the following families, Gerridæ, Veliadæ, Hydrometridæ, Neogeidæ and Mesoveliadæ. They have more or less elongated bodies and slender legs. The beautiful ease with which they glide and skip about over the surface of the water is due to the fine plush-like coating of hairs on the feet and ventral parts of the body by means of which they are enabled to enmesh a thin film of air which sustains their weight on the surface film and keeps the body dry. Unlike the members of the second and third groups the antennæ are well developed and exposed. As they breathe surface air they have no peculiar method of respiration differing from terrestrial forms. Some of these

forms prefer the current of swiftly moving streams, but the majority find more congenial surroundings on the surface of quieter waters and a few may even make excursions upon land, where they may be found in damp situations. They are all carnivorous, using the fore legs for holding their prey, which usually consists of dead or living insects. They all hibernate, concealing themselves at the bottom of their retreat to reappear again on the surface early in the spring.

The forms which walk about on submerged sticks or stem of plants beneath the water belong to the family Nepidæ. The most striking modification they present is a long respiratory tube through which they may breathe surface air while the body is concealed beneath the water. Their legs are long and slender and the fore legs are strong and raptatorial for holding the prey. They more frequently occur in shallow, sluggish streams or ponds well supplied with plant life. Only three species are likely to occur in this vicinity belonging to the genus *Nepa* and *Ranatra*.

The free swimming forms are more abundant, locally, than in the two preceding groups. They usually have the hind pair of legs either broadened or fringed with long hairs to resist the water and serve as a swimming organ. Here are included the families Corixidæ, Belostomatidæ, Naucoridæ and Notonectidæ—a group of carnivorous forms, with the possible exception of *Plea striola*, having the customary short, stout beak. Some of these species are of economic importance as they frequently attack young fish or destroy their eggs.

The Corixidæ, or water boatmen, are the most numerous in species. The hind legs are fringed with long hairs and their fore legs are peculiarly modified, bearing characters which are largely used in their specific differentiation. Carrying a supply of air beneath the elytra, they may remain submerged for an indefinite period.

The Belostomatidæ include some of the largest hemiptera known. The second and third pairs of legs are broad and paddle like and fringed with long hairs. The fore legs are developed into strong clasping organs. They are good swimmers and strong fliers, frequently attracted to light several miles from their breeding places.

The Notonectidæ, or back swimmers, have the not much broadened swimming hind tibiæ fringed with hair and the modified clasping fore-legs. The ventral surface is provided with a mass of long hairs which enmeshes a supply of air for use beneath the surface. The species

differ considerably among themselves as to the quality of water they may select for their abode; *Notonecta undulata*, for instance, may occur in the foulest kind of pools, while others must have comparatively clean water.

The family Naucoridae includes some broad, ovate forms which seem to prefer waters well stocked with vegetable matter. They have the usual talon-like fore legs, but as their hind legs are neither broadened nor fringed with hair, they are poor swimmers, depending more upon walking about upon the submerged plants.

Of all of the Heteroptera perhaps the aquatic species have been less well and accurately known to American entomologists than any other group. This has been due to the fact that because of their wide distribution, ease of collecting, and generally larger size they received the attention of earlier systematists, who were satisfied to give them but a brief and not distinctive characterization to make them recognizable without an examination of the types. These types, for the most part, having either been destroyed or deposited in museums abroad systematists have depended upon the meager descriptions at hand, with the result that there has arisen considerable confusion and uncertainty in fixing certain species. Especially is this so in the family Corixidae.

AQUATIC COLEOPTERA.

BY CHAS. W. LENG,

WEST NEW BRIGHTON, N. Y.

Few, if any, beetles are aquatic throughout all the stages of their existence; even those commonly called water beetles pupate on land and sometimes at least lay their eggs on leaves out of the water. The beetles which are more or less aquatic in habit include the several families of water beetles, the Parnidae and Elmidae, the tribe Donaciini in Chrysomelidae, some tribes of snout beetles and a few other smaller families. All of these exhibit some modifications of structure and vestiture in harmony with their aquatic life, modifications that are on the whole more marked in the adults than in the larvæ, especially in the case of the plant-infesting species; all exhibit a more